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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

LE, THAO P

ART UNIT

PAPER NUMBER

2818

DATE MAILED: 05/20/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application

09/879,231

Examiner

Thao P Le

Applicant(s)

DERDERIAN ET AL.

Art Unit

2818

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 June 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 26-77 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 26-77 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 20.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Oath/Declaration

1. The oath/declaration filed on 07/11/01 is acceptable.

Information Disclosure Statement

2. This office acknowledges of the following items from the Applicant:

Information Disclosure Statements (IDSs) filed on **04/02/03** and made of record as Paper No. 20. The references cited on the PTOL 1449 form have been considered.

3. The specification has been checked to the extent necessary to determine the presence of all possible minor errors. However, the applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the

applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

5. Claims 26-27, 29-33, 35-36, 38-49, 50-54 are rejected under 35 USC 102 (e) as being anticipated by Raaijmakers et al.(will be referred as Ra), U.S. Patent Application Publication No. 20010024387.

Regarding to claims 26, 31, and 38, Ra et al. discloses the method of forming a capacitor fabrication similar to what recited in claims 26, 31 and 38. See Figs. 2-4B and depending specification. Ra discloses the method of forming the capacitor comprising the steps of forming a first electrode 300 (Fig. 8) over a substrate, atomic layer depositing a conductive barrier metal containing layer 304 or forming a conductive barrier layer by chemisorption (Fig. 2, and steps 101, 102, 104 in Fig. 4A, Fig. 4B, or abstract), forming a capacitor dielectric layer 302 and a second electrode (Figs. 8-10).

Regarding to claim 27, Ra et al. discloses that the dielectric layer is formed over the barrier layer.

Regarding to claims 29, 32, 41, Ra et al. discloses that the atomic layer comprises WN, TiN and similar (metal or metal alloy) (pages 7, 13-14).

Regarding to claim 30, Ra et al. discloses that the dielectric layer is tantalum pentoxide. It would have been inherent that tantalum pentoxide has K factor greater than 7 at 20°C (page 14).

Regarding to claims 35-36, Ra et al. discloses that the barrier layer comprises a plurality of atomic layer deposited monolayers.

Regarding to claims 39-40, Ra et al. discloses the atomic layer deposited conductive layer is on the first electrode and wherein the atomic layer deposited conductive layer comprises metal, metal alloy, or a metal-containing compound (Page 7).

Regarding to claim 42, Ra et al. discloses that the second electrode comprise polysilicon and the dielectric layer comprises oxygen.

Regarding to claim 43, Ra et al. discloses a capacitor comprising a first electrode, chemisorbing a layer of a first precursor and a second precursor on the first precursor layer (Fig. 4B), forming a dielectric layer over the first electrode and forming a second electrode over the dielectric layer.

Regarding to claim 44, Ra et al. discloses the first and second precursor layers each consist essentially of a monolayer.

Regarding to claim 45, Ra et al. discloses the first and second precursors comprise Ta and a compound that contains NH₃ (pages 5, 7).

Art Unit: 2818

Regarding to claims 46-48, Ra et al. discloses the atomic layer deposited on the first electrode and the atomic layer comprises metal, metal alloy, or metal containing compound such as TiN, WN, IrO (page 7).

Regarding to claim 49, Ra et al. discloses that the second electrode comprise polysilicon and the dielectric layer is tantalum pentoxide which comprises oxygen.

Regarding to claims 50-51, Ra et al. discloses the substrate comprises a semiconductor wafer and the first electrode comprises HSG polysilicon (abstract).

Regarding to claims 52-54, Ra et al. discloses that the atomic layer comprises TiN or Al₂O₃ (pages 5-7).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 28, 34, 37, 55-77 are rejected under 35 U.S.C. 103(a) as being unpatentable over Raaijmakers (referred as Ra) et al., U.S. Patent Application Publication No. 20010024387.

Regarding to claim 28, Ra doesn't disclose the formation of another barrier layer over the dielectric layer. It would have been obvious in the art to form a barrier layer over the dielectric layer in order to prevent oxygen diffusion from the second electrode to the dielectric layer.

Regarding to claim 34, Ra et al. discloses the use of Ti to form barrier layer but doesn't disclose the use of Pd or Pd alloys. It would have been obvious in the art that Pd or Pd alloys would have been used to form barrier layer since chemical properties of Pd and Pd alloys are similar to Ti's.

Regarding to claim 37, Ra et al. discloses the method of forming a capacitor fabrication similar to what recited in claim 37. See Figs. 2-4B and depending specification. Ra discloses the method of forming the capacitor comprising the steps of forming a first electrode 300 (Fig. 8) over a substrate, atomic layer depositing a conductive barrier layer 304 or forming a conductive barrier layer by chemisorption (Fig. 2, and steps 101, 102, 104 in Fig. 4A, Fig. 4B, or abstract), forming a capacitor dielectric layer 302 and a second electrode (Figs. 8-10). Ra et al. doesn't disclose the barrier layer comprising Pd or Pd alloys. Ra et al. Discloses the barrier layer comprises either Ta, Ti, Al (page 7, step 107 Fig. 4A). It would have been obvious in the art to use Pd or

Pd alloys since the chemical properties of Pd and Pd alloys are similar to those compounds disclosed in Ra.

Still regarding to claims 55-56, it would have been well known in the art that TiN is widely used to form capacitor electrode.

Regarding to claims 57-77, it would have been well known in the art that the substrate comprises semiconductor wafer and the capacitor electrode is made of TiN. Ra discloses the use of Al₂O₃ to form capacitor dielectric in most capacitor structures because the chemical and physical properties of Al₂O₃ are best to prevent oxygen diffusion.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thao P. Le whose telephone number is 703-605-1187. The examiner can normally be reached on Monday-Thursday 7:30am-6: 30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Nelms can be reached on 703-308-4910. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Application/Control Number: 09/879,231

Page 8

Art Unit: 2818

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.



Thao Phuong Le

Examiner

HOAI HO
PRIMARY EXAMINER